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(54) Single-faced corrugated cardboard sheet making machine

(57) A single-faced corrugated cardboard sheet making machine comprising; a first corrugating roll 12 having corrugated protrusions at the outer circumference thereof; a second corrugating roll 14 having corrugated protrusions, which are able to be meshed with the corrugated protrusions, formed at the outer circumference th reof and for forming appropriate corrugations on a core paper web 16 which is caused to pass between this second corrugating roll 14 and the first corrugating roll 12; a pasting mechanism 22 for pasting crest portions of the core paper web 16 on which corrugations are formed; and a plurality of pressure rolls 34,36 which are disposed on the outer circumference surface of the second corrugating roll and in the vicinity of a feeding path of liners 26 which are stuck to the core paper web and is able to press and stick a liner to the core paper web being fed along the outer circumferential surface of the second corrugating roll 14; and being characterized in that the nipping pressure of a pressure roll 34 positioned at the extreme upstream side in the feeding direction of the core paper web 16 and liner 26 of a plurality of pressure rolls 34,36 is set to be identical to or larger than the nipping pressure of the other pressure rolls 36. The angles between lines joining the centres of roll pairs 12-14, 14-34 and 14-36 are also referred to.

FIG.1

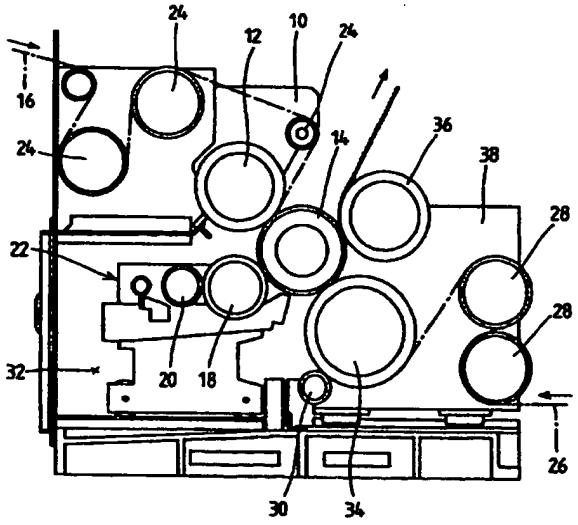

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FIG.1

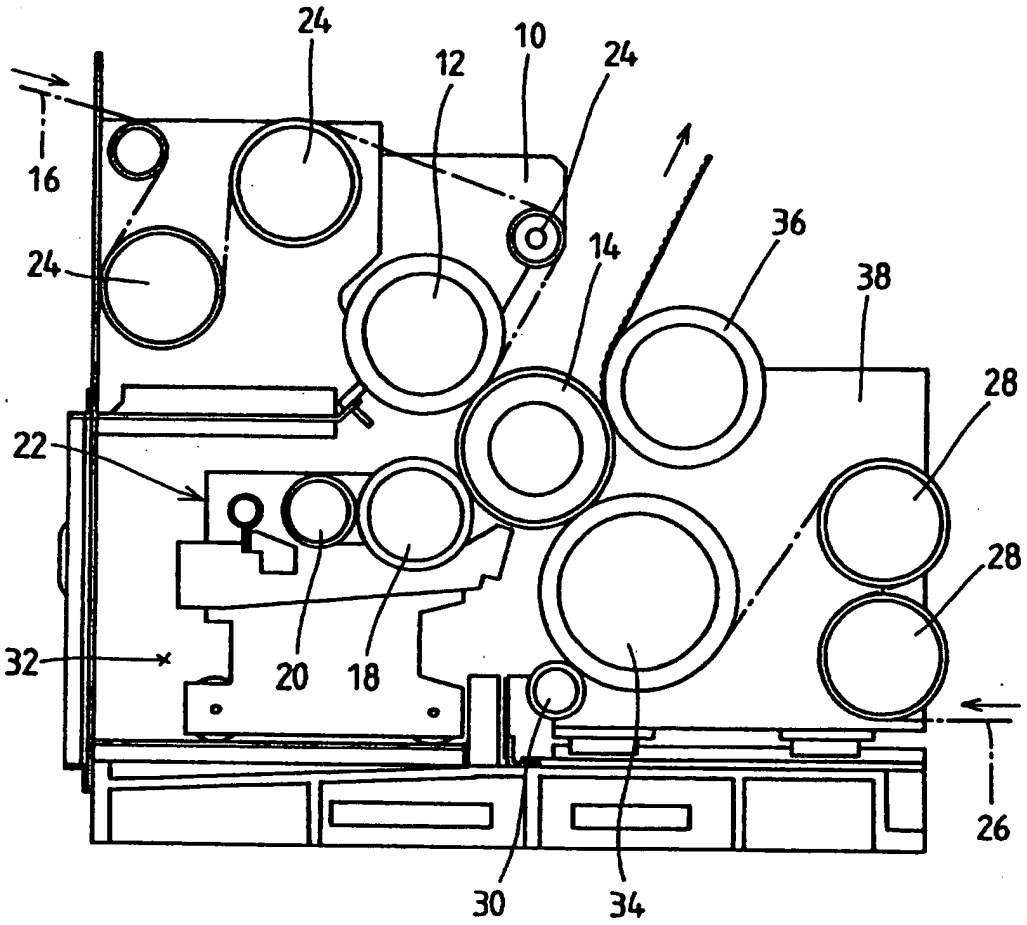


FIG. 2

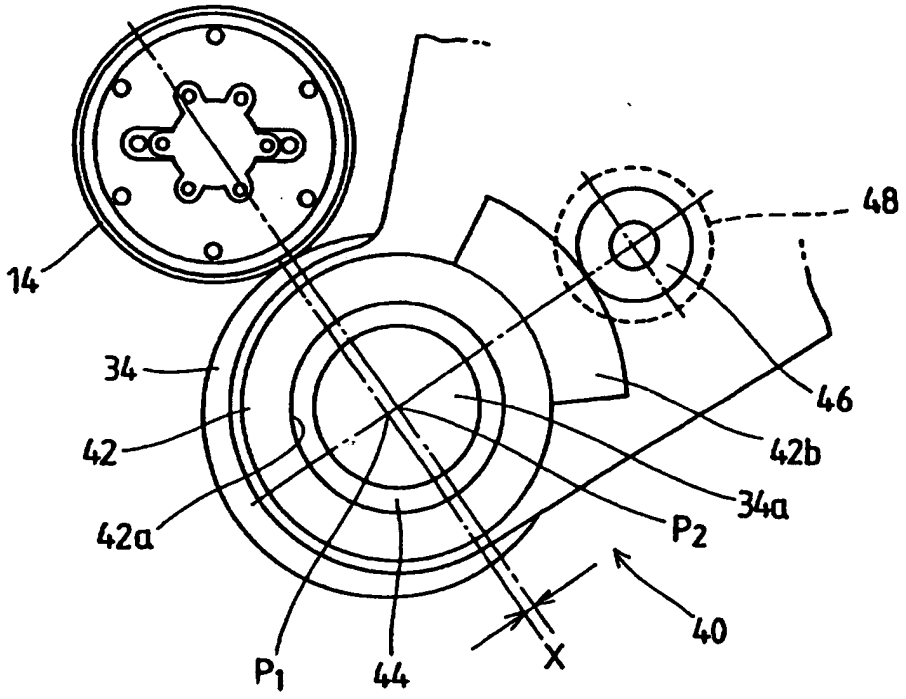


FIG. 3

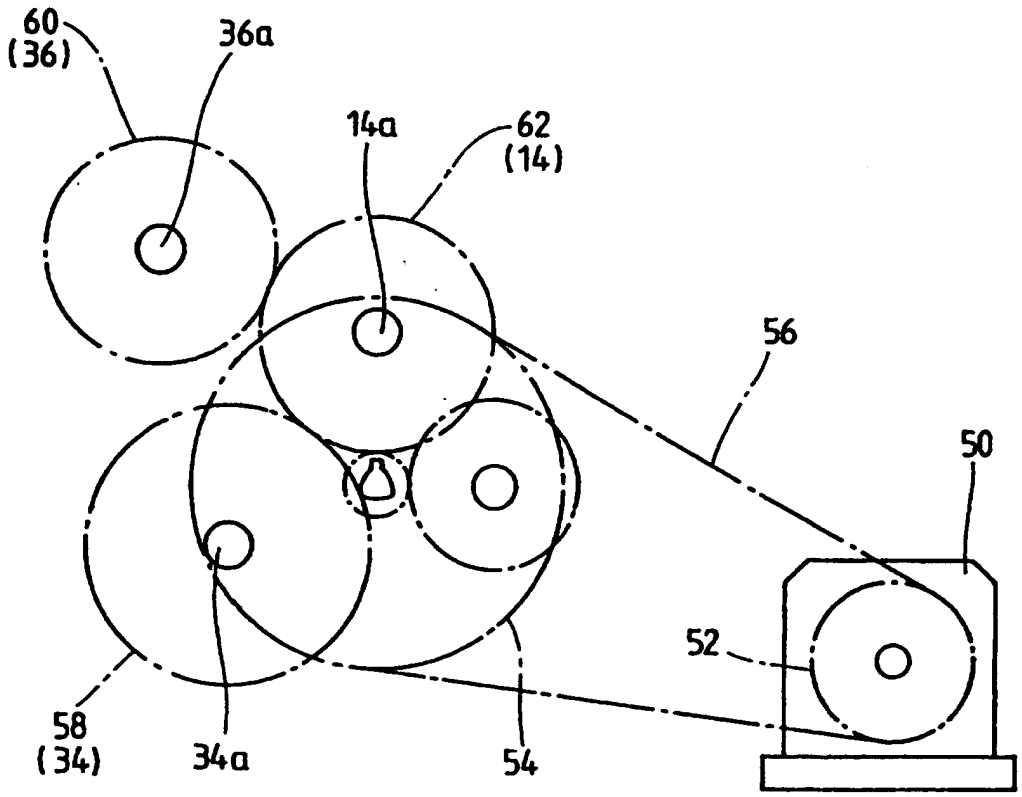


FIG. 4

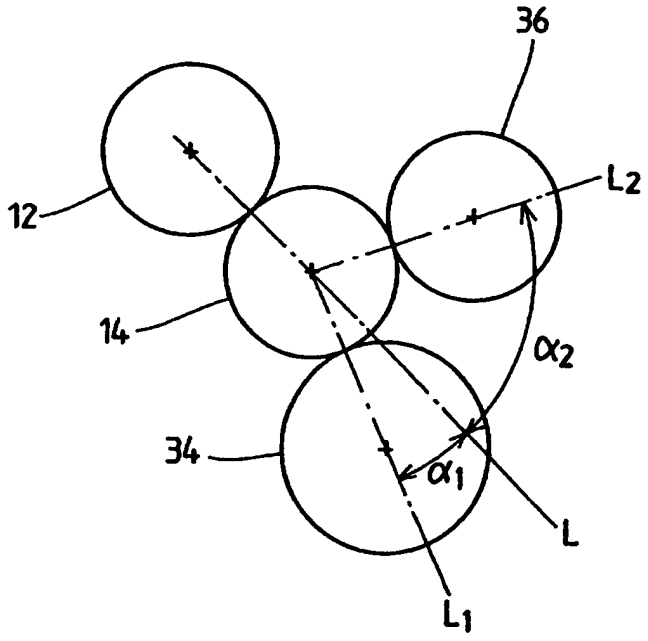


FIG. 6

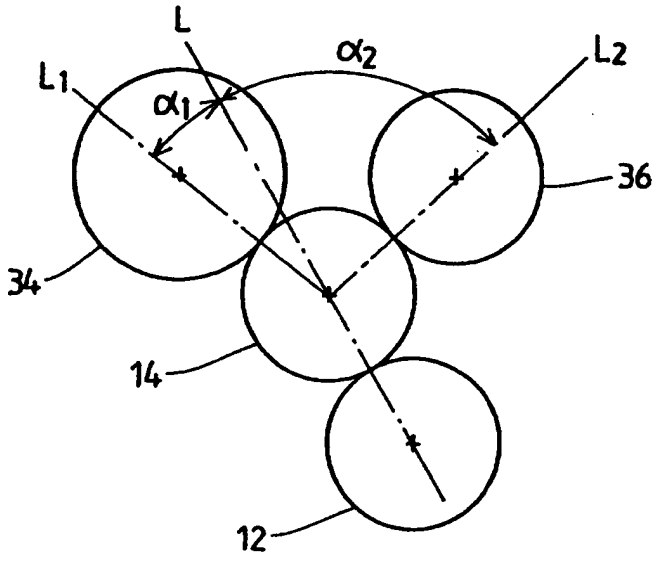


FIG. 5

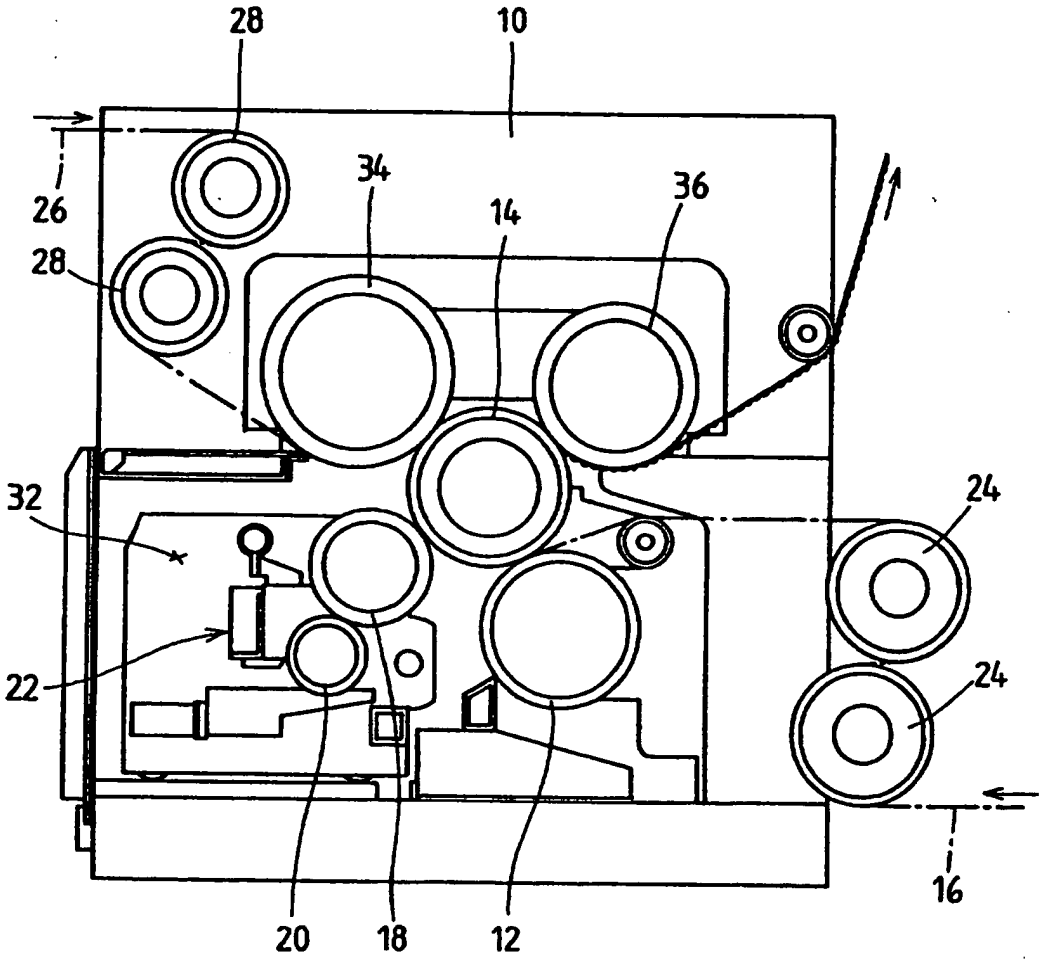


FIG. 7

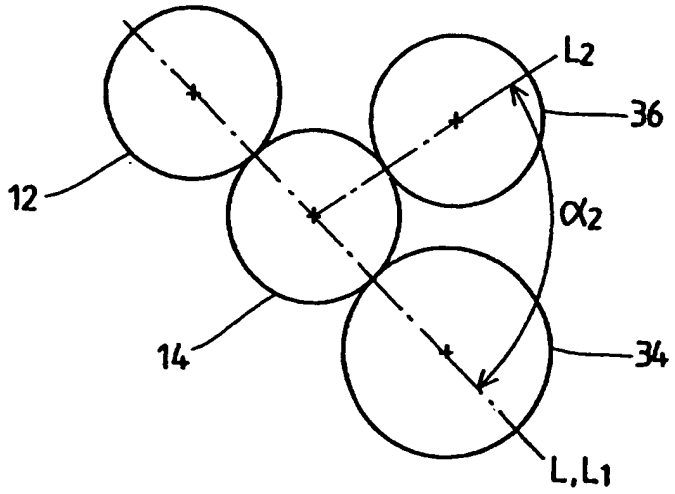


FIG. 8

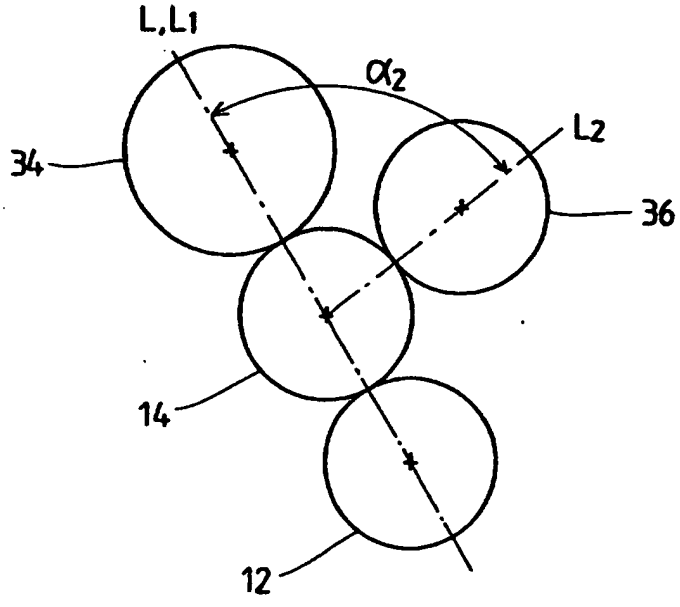
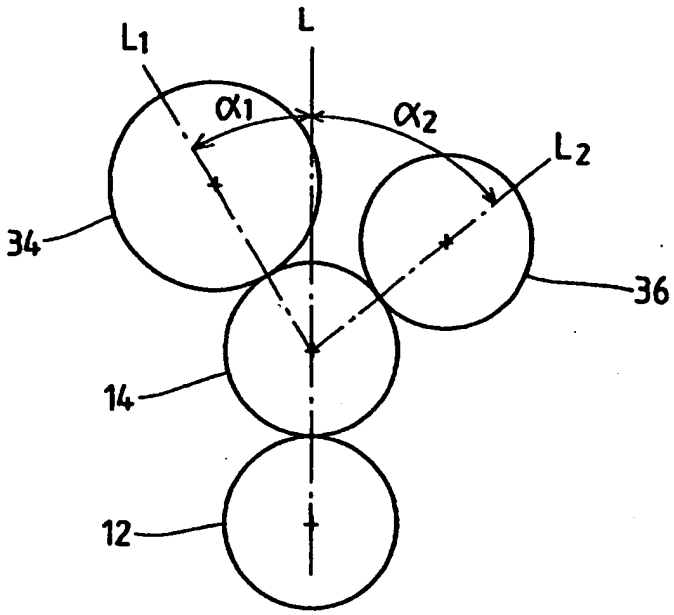


FIG. 9



SINGLE-FACED CORRUGATED CARDBOARD SHEET MAKING MACHINE

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a single-faced corrugated cardboard sheet making machine for producing a single-faced corrugated cardboard in which a core paper web and liner are stuck together by being pinched between by a plurality of pressure rolls and a second roll.

Description of the related art

In a single-faced corrugated cardboard sheet making machine (a so called single facer), a first corrugating roll and a second corrugating roll which respectively have corrugated protrusions on the circumferential surface thereof are rotatably disposed above and below a frame so that they are engaged with each other at said corrugated protrusion, and a pressure roll is disposed so that the pressure roll is brought into contact with said second corrugating roll under pressure with a core paper web and liner pinched therebetween, which will be material paper of a single-faced corrugated cardboard sheet. That is, the core paper web is fed between the first corrugating roll and the second corrugating roll, whereby appropriate protrusions (corrugations) are formed while passing through both the rolls. A starch-based paste is coated onto corrugated crest portions by a pasting roll secured to a pasting mechanism. Furthermore, a liner supplied via a pressure roll from the opposite side of the core paper web is pinched at the core portions of said core paper web between said pressure roll and the second corrugating roll, whereby a single-faced corrugated cardboard sheet is produced by sticking said core paper web and liner together.

A pressure roll which is used in a conventional single-faced corrugated cardboard sheet making machine is composed of a large-diametered metallic roll member and is always pressed toward the second corrugating roll, whereby by giving an appropriate nip pressure to the core paper web and liner to the crest portions of which a paste is applied during passing through both the rolls,

a single-faced corrugated cardboard sheet is produced. In this case, since protrusions consisting of a continuation of crests and valleys are formed at an appropriate pitch on the outer circumference of the second corrugating roll, the center of rotation is caused to be only slightly changed when the contacting position of both the rolls is moved from a crest to a valley or vice verse. Thus, resulting from periodical approach and separation of the rotation centers of both the rolls in line with the rotation of both the rolls, large vibrations and high noise occur when producing single-faced corrugated cardboard sheets, thereby causing the factory working environment to be greatly spoiled. Furthermore, since the rotation centers of both the rolls periodically approach and are separated, crest portions of the second corrugating roll are brought into contact with the surface of a pressure roll, thereby causing impacts (hammering phenomenon) to be periodically brought about. Therefore, there is a shortcoming such that line-like pressing marks are given to the liner surface of the produced single-faced corrugated cardboard sheets in the horizontal direction at the pitches of the crests of the second corrugating roll.

Such various problems as described above result from that the nip pressure is set to be large because it is necessary to stick a core paper web and a liner together by then being pinched at only a point where the second corrugating roll is opposite the pressure roll. Accordingly, such a proposal is presented, where as a means for solving this, two pressure rolls spaced in the circumferential direction of the second corrugating roll are disposed in the vicinity of the second corrugating roll and a core paper web and a liner are stuck together by being pinched between the second corrugating roll and the respective pressure rolls. That is, an initial sticking between a core paper web and a liner is carried out by the first pressure roll positioned at the upstream side in the feeding direction of core paper web being fed along the outer circumference of the second corrugating roll and next a complete sticking therebetween is performed by the second pressure roll positioned at the downstream side in the feeding direction of the core paper web. According to this construction, since the total sum of the nipping pressure of the two pressure rolls may be equivalent to the nipping pressure of a conventional one pressure roll, it is possible to reduce vibrations and noise resulted from the nipping pressure, etc. of the second corrugating roll and each pressure roll, and at the same time pressing marks given to a single-faced corrugated cardb ard

sheet are able to be suppressed.

With a single-faced corrugated cardboard sheet making machine in which two pressure rolls are utilized as described above, it is necessary to securely perform an initial sticking between a core paper web and a liner with the upstream side first pressure roll in order to securely stick the core paper web and linear together since the core paper web and liner are freed from between both the pressure rolls. That is, a good sticking of a core paper web and a liner is achieved by additionally sticking the core paper web and liner together with the downstream side second pressure roll after a nipping pressure of the first pressure roll is set to be large and they are securely stuck together with the upstream side first pressure roll. However, the total sum of the nipping pressure of both the pressure rolls is set in the range equivalent to the nipping pressure in a case where a single pressure roll is used.

In a case where a single pressure roll is used, since said pressure roll is disposed at a position where the axial center thereof is roughly aligned with the reference line passing through the axial center of the first and second corrugating rolls, the first corrugating roll acts as a backup roll when the pressure roll is pressed to the second corrugating roll, whereby it is possible to efficiently give a nipping pressure to the core paper web and liner. Therefore, in a case where two pressure rolls are used, the respective pressure rolls are disposed at a position where the axial centers thereof are displaced in the circumferential direction of the second corrugating roll with respect to said reference line. Therefore, since, with the first pressure roll the axial center of which is greatly apart from the reference line, the nipping pressure is not able to be efficiently given to a core paper web and a liner, no secure initial sticking is performed, and a shortcoming such as a poor sticking occurs. Still furthermore, since a pressing force of a pressure roll, the axial center of which is greatly apart from the reference line, operates on the meshing portion of the first corrugating roll with the second corrugating roll in such a direction that the second corrugating roll is displaced, there is a fear that the formation corrugations of a core paper web by both the corrugating rolls is hindered. That is, although it is found that, by using two pressure rolls, vibrations and noise can be reduced and simultaneously pressing marks are suppressed, it is really unclear where and how both the pressure rolls are positioned with respect to

the second corrugating roll, wherein a nipping pressure is able to be efficiently applied to the core paper web and liner without hindering a corrugation formation of a core paper web.

SUMMARY OF THE INVENTION

In view of the themes and shortcomings which exist in conventional arts described above, the present invention was proposed to preferably solve these shortcomings, and it is therefore an object of the invention to provide a remarkably economical single-faced corrugated cardboard sheet making machine which when producing a single-faced corrugated cardboard sheet in which a core paper web and a liner are stuck together, is able to reduce vibrations and noise generated in the production process and to decrease the number of pressing marks which occur at the liner side, and at the same time is able to securely stick a core paper web and a liner together.

In order to solve these and other problems and to preferably achieve the object thereof, the invention is characterized in that in a single-faced corrugated cardboard sheet making machine comprising a first corrugating roll having corrugated protrusions on the outer circumference thereof, a second corrugating roll having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed on the outer circumference thereof and for forming appropriate corrugations on a core paper web which is caused to pass between this second corrugating roll and said first corrugating roll, a pasting mechanism for pasting crest portions of said core paper web on which corrugations are formed, and a plurality of pressure rolls which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners which are stuck to said core paper web and is able to press and stick a liner to said core paper web fed along the outer circumferential surface of said second corrugating roll, the nipping pressure of a pressure roll positioned at the extreme upstream side in the feeding direction of said core paper web and liner in a plurality of pressure rolls is set to be identical to or larger than the nipping pressure of the other pressure roll.

In rder to solve the above object, another feature of th invention is that in a single-faced corrugated cardboard sheet making machine comprising a

first corrugating roll having corrugated protrusions at the outer circumference thereof, a second corrugating roll having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web which is caused to pass between this second corrugating roll and said first corrugating roll, a pasting mechanism for pasting crest portions of said core paper web on which corrugations are formed, and a plurality of pressure rolls which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners which are stuck to said core paper web and is able to press and stick a liner to said core paper web fed along the outer circumferential surface of said second corrugating roll, the nipping pressure of the delivery side pressure roll positioned at the downstream side in the feeding direction of said core paper web and liner is set to be identical to or smaller than that of the feeding side pressure roll positioned at the upstream side in the feeding direction.

In order to achieve said object, still another feature of the invention is that in a single-faced corrugated cardboard sheet making machine comprising a first corrugating roll having corrugated protrusions at the outer circumference thereof, a second corrugating roll having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web which is caused to pass between this second corrugating roll and said first corrugating roll, a pasting mechanism for pasting crest portions of said core paper web on which corrugations are formed, and a plurality of pressure rolls which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners which are stuck to said core paper web and is able to press and stick a liner to said core paper web fed along the outer circumferential surface of said second corrugating roll, the nipping pressure of a feeding side pressure roll positioned at the upstream side in the feeding direction of said core paper web and liner is set to be identical to or larger than that of a delivery side pressure roll positioned at the downstream side in the feeding direction.

In order to achieve said object, yet another feature of the invention is that in a single-faced corrugated cardboard sheet making machine c mprising a

first corrugating roll having corrugated protrusions at the uter circumference thereof, a second corrugating roll having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web which is caused to pass between this second corrugating roll and said first corrugating roll, a pasting mechanism for pasting crest portions of said core paper web on which corrugations are formed, and a plurality of pressure rolls which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners which are stuck to said core paper web and is able to press and stick a liner to said core paper web fed along the outer circumferential surface of said second corrugating roll, an upstream side pressure roll in the feeding direction of said core paper web and liner is disposed with respect to the second corrugating roll (14) in such a manner that the intersecting angle of the axial center line which connects the axial center of said pressure roll to the axial center of the second corrugating roll and the reference line passing through the axial centers of the first corrugating roll and second corrugating roll is set to be identical to or smaller than the intersecting angle of the axial center line which connects the axial center of the downstream side pressure roll in the feeding direction to the axial center of the second corrugating roll and the reference line.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a brief construction view showing a single-faced corrugated cardboard sheet making machine according to a first preferred embodiment of the invention.

Fig.2 is an explanatory view showing an eccentric mechanism of a first pressure roll in the first preferred embodiment.

Fig.3 is a brief construction view showing a drive system of a second corrugating roll and both pressure rolls in the first preferred embodiment.

Fig.4 is an explanatory view showing the relationship between the second corrugating roll and both pressure rolls in the first preferred emb dim nt.

Fig.5 is a brief construction view showing a single-faced corrugated cardboard sheet making machine according to a second preferred embodiment of the invention.

Fig.6 is an explanatory view showing the relationship between the second corrugating roll and both pressure rolls in the second preferred embodiment.

Fig.7 is an explanatory view showing a modified example of an arrangement of both pressure rolls to the second corrugating roll pertaining to the construction of the first preferred embodiment.

Fig.8 is an explanatory view showing a modified example of an arrangement of both pressure rolls to the second corrugating roll pertaining to the construction of the second preferred embodiment.

Fig.9 is an explanatory view showing a modified example of an arrangement of corrugating rolls pertaining to the construction of the second preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Next, preferred embodiments of a single-faced corrugated cardboard sheet making machine according to the invention is described below with reference to the accompanying drawings.

(First preferred embodiment)

Fig.1 shows a brief construction of a single-faced corrugated cardboard sheet making machine according to a first preferred embodiment, wherein a first corrugating roll 12 having corrugated protrusions at the outer circumference thereof and a second corrugating roll 14 similarly having corrugated protrusions are pivotally supported at the frame body 10. The rotating axis of the first corrugating roll 12 is positioned diagonally upward of the rotating axis of the second corrugating roll 14, wherein the respective

corrugated protrusions are able to be meshed with each other via a cor paper web 16 (described later). A pasting mechanism consisting of a pasting roll 18 and a doctor roll 20 is disposed right below said first corrugating roll 12 and diagonally downward of the second corrugating roll 14. The core paper web 16 is supplied from the left side raw core paper supplying source (not illustrated) in Fig.1 to the meshing area between the first corrugating roll 12 and the second corrugating roll 14 via a plurality of guide rolls 24, whereby appropriate corrugations are formed by passing through said meshing area. The crest portions of the core paper web 16 at which corrugations are formed are pasted by said pasting mechanism 22. Thereafter, the core paper web 16 is oriented upwards along the outer circumference of the second corrugating roll 14 with its feeding direction reversed. Furthermore, the liner 26 is supplied from the right side raw liner supplying source (not illustrated) in Fig.1 to the second corrugating roll 14 via two roll-like preheaters 28,28 which are heated with steam and are fed upward while being united to the crest portions of the core paper web 16, to which paste is coated by the pasting mechanism. Construction is made such that high temperature steam is circulated into the guide rolls 24 from a supply source (not illustrated) so as to heat the core paper web 16.

Said pasting mechanism 22 is made open to the sides of the first corrugating roll 12 and second corrugating roll 14, and at the same time the intermediate portion between the opening thereof and a sealing roll 30 placed immediately below the first corrugating roll 12 and second corrugating roll 14 are accommodated in a compression chamber 32 which is in an almost enclosed state. Compressed air is supplied into said compression chamber 32 from a supply source (not illustrated), and the compression chamber is set to have a slightly higher pressure (for example, 0.15 millibars higher) than the atmospheric pressure. In this case, the outer surface side of the second corrugating roll 14, which faces the compression chamber 32, is set to have the atmospheric pressure by circumferential grooves (not illustrated) formed at an appropriate interval in the axial direction. Therefore, a core paper web 16 at which corrugations are formed by passing between the first and second corrugating rolls 12,14, is able to be transferred in a stabilized state where the same is pressed to the roll surface by a pressure difference between the compression chamber 32 and the outer surface of the second corrugating roll 14. Accordingly, the core paper web 16 which is oriented upwards along the outer

surface of the second corrugating roll 14 with the feeding direction thereof reversed is able to be stuck to a linear 26 without fail by two pressure rolls 34,36 described later.

Two pressure rolls 34,36 which are used to stick the core paper web 16 to the liner 26 in cooperation with the second corrugating roll 14 are spaced in the circumferential direction of the second corrugating roll 14 and disposed at the opposite side of the first corrugating roll 12 with said second corrugating roll put therebetween. That is, as shown in Fig.1, at the outer circumferential surface of the second corrugating roll 14 and at a downward position in the vicinity of a feeding path of said liner 26, the feeding side first pressure roll 34 is rotatably disposed, and said core paper web 16 which is fed along the outer circumferential surface of the second corrugating roll 14 and the liner 26 to be stuck thereto are devised to be pressed to the corresponding second corrugating roll 14. Furthermore, at the outer circumferential surface of the second corrugating roll 14 and at an upward position in the vicinity of the feeding path of said liner 26, the delivery side second pressure roll 36 is rotatably disposed and said core paper web 16 and liner 26 which are fed along the outer circumferential surface of the second corrugating roll 14 are devised to be pressed to the corresponding second corrugating roll 14. That is, the first pressure roll 34 and the second pressure roll 36 are disposed in the vertical direction at the outer circumferential surface and in the vicinity of the liner feeding path. After the liner 26 passed through said preheater 28 is supplied to the pasting area with the core paper web 16 along the outer circumferential face of the feeding side first pressure roll 34 and is further transferred to the pasting area between the delivery side second pressure roll 36 and the second corrugating roll 14. Furthermore, in this preferred embodiment, both said pressure rolls 34,36 and preheaters 28,28 are disposed on a moving frame 38 which is constructed to be movable with respect to the frame body 10 on which said corrugating rolls 12,14 are disposed, and are such that they are able to be positioned at an operating position where both the pressure rolls 34,36 are caused to come near the second corrugating roll 14 and a retracted position where both the pressure rolls 34,36 are made apart from the second corrugating roll 14.

Both said pressure rolls 34,36 are connected to a high temperature

steam supply source (not illustrated), whereby high temperature steam is circulated in said rolls to raise the temperature of the roll surface to an appointed temperature level. Accordingly, the liner 26 which is brought into contact with the pressure rolls 34,36 is heated to give heat to the pasting portion of the said core paper web 16 and liner 26, whereby the gelling of starch-based paste is promoted to cause the sticking of the liner 14 and core paper web 16 to be securely performed. Furthermore, the first pressure roll 34 is brought into contact with said sealing roll 30 when said moving frame 38 is positioned at the operating position, whereby said compression chamber 32 is able to be kept enclosed.

The disposition of the first pressure roll 34 and the second pressure roll 36 with respect to the reference line L passing through the axial center of said first corrugating roll 12 and second corrugating roll 14 is, as shown in Fig.4, set so that the intersecting angle α 1 of the axial center line L1, which connects the axial center of the first pressure roll 34 and the axial center of the second corrugating roll 14, and the reference line L is made smaller than the intersecting line α 2 of the axial center line L2, which connects the axial center of the second pressure roll 36 and the axial center of the second corrugating roll 14, and the reference line L (that is, α 1$<\alpha$ 2). That is, the first pressure roll 34 is disposed roughly opposite the first corrugating roll 12 with the second corrugating roll 14 intervened therebetween. The first pressure roll 34 is pressed in the axial center direction of the second corrugating roll 14 to give an appropriate nipping pressure, whereby the first corrugating roller 12 backs up the second corrugating roll 14. Therefore, it is possible to efficiently give a nipping pressure to the core paper web 16 and liner 26. Accordingly, even though the nipping pressure of the first pressure roll 34 is set to be larger than the nipping pressure of the second pressure roll 36, there is almost no case where the second corrugating roll 14 operates in a direction deviating from the meshing portion with the first corrugating roll 12, whereby the initial pasting between the core paper web 16 and the liner 26 is able to be carried out without fail. Furthermore, the nipping pressure of the second pressure roll 36 is set to a value (a smaller value than the nipping pressure of the first pressure roll 34) at which the core paper web 16 and liner 26 initially pasted by the first pressure roll 34 are auxiliarily stuck together. However, the total sum of the nipping pressure of both pressure rolls 34,36 is set in a range where the same is almost

equivalent to the nipping pressure in a case where a single pressure roll is used. Furthermore, as clearly shown in Fig.1, the diameter of the first pressure roll 34 is set to be larger than the diameter of the second pressure roll 36, and they are constructed so that a nipping pressure is more efficiently given to the core paper web 16 and liner 26. Furthermore, in this preferred embodiment, the diameter of the second pressure roll 36 is set to be identical to that of the second corrugating roll 14, whereby the diameter of the first pressure roll 34 is made larger than that of the second corrugating roll 14.

Both said pressure rolls 34,36 are constructed so that they are respectively independently movable in order to approach the second corrugating roll 14 and separate therefrom by an eccentric mechanism 40 and that an adequate nipping pressure is able to be set in response to the material, etc., in addition to the thickness of core paper web 16 and liner 26. Since for example such a type as shown in Fig.2 may be employed as an eccentric mechanism 40, the eccentric mechanism 40 secured at the first pressure roll 34 side is described below. That is, the rotating axis 34a of the first pressure roll 34 is rotatably internally inserted into a through hole 42a of a lace 42 rotatably pivoted at the moving frame 38 via a bearing 44. This lace 42 has a fan-shaped gear 42b formed integrally therewith at a part of the circumferential surface thereof, and is designed so that the center P1 of the through hole 42a (center of the rotating axis 34a of the first pressure roll 34) is displaced an appointed dimension x from the center P2 of the outer circumferential surface of the lace. The fan-shaped gear 42b is meshed with a pinion gear 46 pivotally supported rotatably at the moving frame 38, and this pinion gear 46 is connected to a motor 48 disposed at the moving frame 38, whereby appropriate rotation is given to the pinion gear 46. That is, if the pinion gear 46 is rotated by driving said motor 48, said fan-shaped gear 42b meshed therewith is caused to rotate together with the lace 42. At this time, since the center P2 of the outer circumferential surface of the lace 42 on which said fan-shaped gear 42b is formed is displaced an appointed dimension x from the center P1 of the through hole 42a as shown above, the first pressure roll 34 is caused to eccentrically move in line with rotation of said lace 42, whereby it is possible to adjust the nipping pressure between the first pressure roll 34 and the second corrugating roll 14 by changing the distance between the axial centers of the first pressure roll 34 and the second corrugating roll 14. Furthermore, the eccentric

mechanism 40 is disposed at both sides in the axial direction of the first pressure roll 34 and is for eccentric movements of the first pressure roll by synchronously driving a pair of motors 48,48.

As shown in Fig.3, a drive motor 50 is disposed at said frame body 10, and an endless belt 56 is applied between a pulley secured at said motor 50 and a large-diametered pulley 54 rotatably pivoted at the frame body 10. A gear secured at the axis of the large-diametered pulley 54 is meshed with a gear secured at the rotating axis 14a of the second corrugating roll 14 (neither of the gears are illustrated), whereby the second corrugating roll 14 is able to be rotated at an appointed speed by driving said drive motor 50. A gear 58 is disposed at the rotating axis 34a of the first pressure roll 34, and simultaneously a gear 60 is disposed at the rotating axis 36a of the second pressure roll 36, wherein both the gears 58,60 are commonly meshed with another gear 62 which is secured at the rotating axis 14a of the second corrugating roll 14. That is, both the pressure rolls 34,36 are devised to positively rotate in line with rotation of the second corrugating roll 14. Furthermore, since the gear 62 of the second corrugating roll 14 and the gear 60 of the second pressure roll 36 are set so as to have the same diameter and the gear 58 of the first pressure roll 34 is set to have a larger diameter than that of the gear 62 of the second corrugating roll 14, it is constructed that both the pressure rolls 34,36 are able to rotate at the same peripheral speed as that of the second corrugating roll 14.

(Actions of the first preferred embodiment)

Next, a description is given of the actions of a single-faced corrugated cardboard sheet making machine according to the first preferred embodiment described above. When making a single-faced corrugated cardboard sheet, by causing said first pressure roll 34 and the second pressure roll 36 to approach the second corrugating roll 14, a core paper web 16 and a liner 14 which are fed along the outer circumference of the second corrugating roll 14 are caused to enter a state capable of being pressed on the corrugating rolls by both the pressure rolls 34,36. Furthermore, in this case, the nipping pressure of both the pressure rolls 34,36 is set to be smaller than the nipping pressure of such a constructi n wh re a conventional single pressure roll is used, and th total

sum is devised to be almost equivalent to the conventional nipping pressure. The nipping pressure of the first pressure roll 34 is set to become larger than the nipping pressure of the second pressure roll 36 (that is, the nipping pressure of the second pressure roll 36 is made smaller than that of the first pressure roll 34).

By driving and rotating said first and second corrugating rolls 12,14, said first pressure roll 34 and second pressure roll 36 are driven and rotated at the same peripheral speed as that of the second corrugating roll 14 by a drive system shown in Fig.3. In this state, a core paper web 16 being fed from a material paper supply source to the meshing area between the first corrugating roll 12 and the second corrugating roll 14 via a guide roll 24 is corrugated at an appropriate flute by passing through the corresponding area. After the crest portions of the core paper web 16 on which corrugated protrusions are formed are pasted by said pasting mechanism 22, the core paper web 16 are oriented upward along the outer circumference of the second corrugating roll 14 with the feeding direction reversed (See Fig.1).

Furthermore, a liner 26 being fed from a material liner supply source via said preheaters 28,28 is fed to the pasting area between the second corrugating roll 14 and the first pressure roll 34. This liner 26 is press-pinched to the crest portions of said core paper web 16 between the first pressure roll 34 and the second corrugating roll 14, wherein the initial sticking of the core paper web 16 and liner 26 are carried out. Since the first pressure roll 34 is set so that the intersecting angle α 1 of said axial center line L1 and the reference line L is made small and the first pressure roll 34 is set to be large-diametered, the nipping pressure of said roll 34 is able to be efficiently given to the core paper web 16 and liner 26, and the initial sticking of both the core paper web 16 and liner 26 is able to be completely achieved. Furthermore, since a pressing force of the first pressure roll 34 does not operate in the direction of displacing the second corrugating roll 14 relative to the meshing area between the first corrugating roll 12 and the second corrugating roll 14, the pressing force does not hinder the formation of corrugations of a core paper web 16 at either of the corrugating rolls 12,14 at all.

The core paper web 16 and liner 26 which are press-pinched by said

second corrugating roll 14 and first pressure roll 34 and are initially stuck together are fed to th pasting area between the second corrugating roll 14 and the second pressure roll 36, wherein the core paper web 16 and liner are completely stuck together to produce a single-faced corrugated cardboard sheet. Furthermore, since the nipping pressure of the second pressure roll 36 is set to a small value at which the core paper web 16 and liner 26 are able to be auxiliarily stuck together, there is no fear that the position of the second corrugating roll 14 is displaced by the pressing force of said second pressure roll. Furthermore, since the peripheral speeds of the first pressure roll 34 and the second pressure roll 36 are designed to be coincident with the peripheral speed of the second corrugating roll 14, it is possible to prevent any sticking error from occurring due to a difference in the peripheral speeds between the second corrugating roll 14 and both the pressure rolls 34,36 and to securely stick the core paper web 16 and liner 26 together.

Thus, in the first preferred embodiment, since the core paper web 16 and liner 26 are stuck together by two pressure rolls 34,36, the nipping pressure of the respective pressure rolls 34,36 can be set to be smaller than that in a case where a single pressure roll is employed, whereby vibrations and noise which may be produced when making a single-faced corrugated cardboard sheet can be remarkably decreased, and at the same time the number of pressing marks produced at the liner side of a single-faced corrugated cardboard sheet can be also decreased. Furthermore, since the first pressure roll 34 is disposed with respect to the second corrugating roll 14 in such a manner that the intersecting angle α 1 of the axial center line L1 and the reference line L is made smaller and the corresponding pressure roll 34 is made large-diametered, it is possible to efficiently give a large nipping pressure to the core paper web 16 and liner 26, whereby the initial sticking of both the core paper web 16 and liner 26 can be completely achieved.

(Second preferred embodiment)

Fig.5 shows a brief construction of a single-faced corrugated cardboard sheet making machine according to a second preferred embodiment of the inventi n, wherein the disposing detail f tw pressur rolls 12,14 is different from the first preferred embodiment described above. That is, the sec nd

pressure roll 14 is pivotally supported to be rotatable diagonally upward of the first corrugating roller 12 which is pivotally supported to be rotatable at the frame body 10, wherein the respective corrugated protrusions are meshed with each other via a core paper web 16. Furthermore, a pasting mechanism 22 accommodated in a compression chamber 22 is disposed diagonally downward of the second corrugating roll 14 at the side of the first corrugating roll 12. The core paper web 16 is fed from a material paper supply source (not illustrated) at the right side in Fig.5 to the meshing area between the first corrugating roller 12 and the second corrugating roll 14 via a plurality of guide rolls 24, whereby appropriate corrugations are able to be formed by passing through the corresponding meshing area. After the crest portions of the core paper web 16 on which corrugations are formed are pasted by said pasting mechanism 22, and the core paper web 16 is oriented upward along the outer circumferential surface of the second corrugating roll 14 with the feeding direction reversed. Furthermore, the liner 26 is fed from the left side material liner supply source (not illustrated) in Fig.5 to the second corrugating roll 14 via a plurality of preheaters 28 and is transferred upward in a state that the liner 26 is united to the pasted crest portions of the core paper web 16.

Two pressure rolls 34,36 are almost horizontally disposed upward of said second corrugating roll 14 in a state where they are spaced in the circumferential direction of the second corrugating roll 14. That is, the feeding side first press roller 34 is rotatably disposed at the upstream side (the left side in Fig.5) in the feeding direction of the core paper web 16 being fed along the outer circumferential surface of the second corrugating roll 14, and at the same time the delivery side second pressure roll 36 is rotatably disposed at the downstream side (the right side in Fig.5). And the core paper web 16 being fed along the outer circumferential surface of the second corrugating roll 14 and liner 26 to be stuck thereto are press-pinched between the respective pressure rolls 34,36 and the second corrugating roll 14, whereby they are securely stuck together. The first pressure roll 34 and second pressure roll 36 are rotated at the same peripheral speed as that of the second corrugating roll 14 by a drive system and an eccentric mechanism which are similar to those of the first preferred embodiment.

In the second preferred embodiment, the first pressure roll 34 and the

second pressure roll 36 are arranged, as shown in Fig.6, so that the intersecting angle α 1 of the axial center line L1, which connects the axial center of the first pressure roll 34 with the axial center of the second corrugating roll 14, and the reference line L is made smaller than the intersecting angle α 2 of the axial center line L2, which connects the axial center of the second pressure roll 36 with the axial center of the second corrugating roll 14, and the reference line L (that is, α 1 < α 2). Furthermore, since the diameter of the second pressure roll is set to be almost equivalent to that of the second corrugating roll 14 and the diameter of the first pressure roll 34 is set to be larger than that of the second pressure roll 36, it is possible to efficiently give the nipping pressure of the first pressure roll 34 to the core paper web 16 and liner 26, and to securely carry out the initial sticking of the core paper web 16 and liner 26. Furthermore, the nipping pressure of the first pressure roll 34 is set to a larger value than that of the second pressure roll (that is, the nipping pressure of the second pressure roll 36 is smaller than that of the first pressure roll 34), and the nipping pressure of the second pressure roll 36 is set to such a value that the core paper web 16 and liner 26 which are initially stuck together by the first pressure roll 34 are able to be auxiliarily stuck together.

That is, in the second preferred embodiment, since the core paper web 16 and liner 26 are stuck together with by two pressure rolls 34,36, it is identical to the first preferred embodiment in that it is possible to remarkably reduce vibrations and noise which may be produced when making a single-faced corrugated cardboard sheet and to reduce the number of pressing marks produced at the liner side of a single-faced corrugated cardboard sheet. Still furthermore, even though the nipping pressure of the first pressure roll 34 is set to be large, it is possible to efficiently give the nipping pressure to both the core paper web 16 and liner 26 without hindering the formation of corrugations of the core paper web 16, and it is possible to carry out the initial sticking of core paper web 16 and liner 26 without fail.

(Modified embodiment)

In each of the preferred embodiments described above, a description was given of a case where the first pressure roll 34 is arranged so that the axial center line L1 and reference line have an appointed angular difference.

However, the invention is not limited to this case. For example, as shown in Fig.7 and Fig.8, the first pressure roll 34 may be disposed at a position where the axial center line L1 and the reference line L may be made coincident with each other (that is, the intersecting angle α 1 of the axial center line L1 and the reference line L is zero). Furthermore, it is also possible that the intersecting angle α 1 of the first pressure roll 34 is made identical to the intersecting angle α 2 of the second pressure roll 36 (that is, α 1 = α 2). Furthermore, the nipping pressure of both the pressure rolls 34,36 may be set to be identical to each other.

Furthermore, The arrangement of both said corrugating rolls 12,14 is not limited to that described in each of the above preferred embodiments. For example, as shown in Fig.9, such a construction may be employed where the second corrugating roll 14 is disposed immediately above the first corrugating roll and two pressure rolls 34,36 are disposed at the outer circumferential surface upward of said second corrugating roll 14. In the construction shown in Fig.9, by setting the nipping pressure of the first pressure roll 34 to a value which is equal to or larger than that of the second pressure roll 36 and setting the intersecting angle α 1 of the first pressure roll 34 to a value which is equal to (α 1 = α 2) or larger (α 1 < α 2) than the intersecting angle α 2 of the second pressure roll 36, it is possible to securely stick the core paper web 16 to the liner 26.

Still furthermore, it may be possible to set the intersecting angle α 2 of the axial center L2 of the delivery side second pressure roll 36 and the reference line L to a smaller value than the intersecting angle α 1 of the axial center line L1 of the feeding side first pressure roll 34 and the reference line L. Furthermore, in these preferred embodiments, although a core paper web is stuck to a liner 26 by two pressure rolls, three or more pressure rolls may be disposed in the vicinity of the outer circumference of the second corrugating roll, the intersecting angle of the axial center line of the feeding side pressure roll located at the extreme upstream side thereof and the reference line may be set to a value which is equal to the intersecting angle of the other pressure rolls or the smallest value among the others, and the nipping pressure of the c rresp nding feeding sid pr ssure roll may be set to be identical to r larger than that of the other pressure rolls. Furthermore, as a means for retaining the

core paper web at the outer circumferential surface of th second corrugating roll, such a construction may be adopted, where a core paper web is absorbed and retained at the outer circumferential surface of the second corrugating roll by a through hole drilled in the circumferential groove with the inside of the corresponding roll kept at a negative pressure.

WHAT IS CLAIMED IS:

1. A single-faced corrugated cardboard sheet making machine comprising:

a first corrugating roll (12) having corrugated protrusions at the outer circumference thereof;

a second corrugating roll (14) having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web (16) which is caused to pass between this second corrugating roll (14) and said first corrugating roll (12);

a pasting mechanism (22) for pasting crest portions of said core paper web (16) on which corrugations are formed; and

a plurality of pressure rolls (34,36) which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners (26) which are stuck to said core paper web (16) and is able to press and stick a liner to said core paper web (16) being fed along the outer circumferential surface of said second corrugating roll (14);

and being characterized in that

the nipping pressure of a pressure roll (34) positioned at the extreme upstream side in the feeding direction of said core paper web (16) and liner (26) of a plurality of pressure rolls (34,36) is set to be identical to or larger than the nipping pressure of the other pressure rolls (36).

2. A single-faced corrugated cardboard sheet making machine comprising:

a first corrugating roll (12) having corrugated protrusions at the outer circumference thereof;

a second corrugating roll (14) having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web (16) which is caused to pass between this second corrugating roll (14) and said first corrugating roll (12);

a pasting mechanism (22) for pasting crest portions of said core paper web (16) on which corrugations are formed; and

a plurality of pressure rolls (34,36) which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners (26) which are stuck to said core paper web (16) and is

able to press and stick a liner to said core paper web (16) being fed along the outer circumferential surface of said second corrugating roll (14);

and being characterized in that

the nipping pressure of the delivery side pressure roll (36) positioned at the downstream side in the feeding direction of said core paper web (16) and liner (26) is set to be identical to or smaller than that of the feeding side pressure roll (34) positioned at the upstream side in the feeding direction.

3. A single-faced corrugated cardboard sheet making machine comprising:

a first corrugating roll (12) having corrugated protrusions at the outer circumference thereof;

a second corrugating roll (14) having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web (16) which is caused to pass between this second corrugating roll (14) and said first corrugating roll (12);

a pasting mechanism (22) for pasting crest portions of said core paper web (16) on which corrugations are formed; and

a plurality of pressure rolls (34,36) which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners (26) which are stuck to said core paper web (16) and is able to press and stick a liner to said core paper web (16) being fed along the outer circumferential surface of said second corrugating roll (14);

and being characterized in that

the nipping pressure of the feeding side pressure roll (34) positioned at the upstream side in the feeding direction of said core paper web (16) and liner (26) is set to be identical to or larger than that of the delivery side pressure roll (36) positioned at the downstream side in the feeding direction.

4. A single-faced corrugated cardboard sheet making machine as set forth in claim 1, 2 or 3, wherein the pressure roll (34) at the extreme upstream side in the feeding direction of said core paper web (16) and liner (26) is disposed with respect to the second corrugating roll (14) in such a relationship that the intersecting angle (α 1) of the axial center line (L1), which connects the axial center of said pressure roll (34) with that of the second corrugating roll (14), and the reference line (L) which passes through the axial centers of the first

corrugating roll (12) and the second corrugating roll (14) is determined to be identical to or smaller than the intersecting angle (α 2) of the axial center line (L2), which connects the axial center of the other pressure roll (36) and that of the second corrugating roll (14), and the reference line (L).

5. A single-faced corrugated cardboard sheet making machine as set forth in claim 4, wherein the diameter of the pressure roll (14) of which the intersecting angle (α 1) of said reference line (L) and axial center line (L1) is set to a minimum value is set to be identical to or larger than the diameter of the other pressure roll (36).

6. A single-faced corrugated cardboard sheet making machine comprising:

a first corrugating roll (12) having corrugated protrusions at the outer circumference thereof;

a second corrugating roll (14) having corrugated protrusions, which are able to be meshed with said corrugated protrusions, formed at the outer circumference thereof and for forming appropriate corrugations on a core paper web (16) which is caused to pass between this second corrugating roll (14) and said first corrugating roll (12);

a pasting mechanism (22) for pasting crest portions of said core paper web (16) on which corrugations are formed; and

a plurality of pressure rolls (34,36) which are disposed on the outer circumference surface of said second corrugating roll and in the vicinity of a feeding path of liners (26) which are stuck to said core paper web (16) and is able to press and stick a liner to said core paper web (16) being fed along the outer circumferential surface of said second corrugating roll (14);

and being characterized in that

the pressure roll (34) at the upstream side in the feeding direction of said core paper web (16) and liner (26) is disposed with respect to the second corrugating roll (14) in such a relationship that the intersecting angle (α 1) of the axial center line (L1), which connects the axial center of said pressure roll (34) with that of the second corrugating roll (14), and the reference line (L) which passes through the axial centers of the first corrugating roll (12) and the second corrugating roll (14) is determined to be identical to or smaller than the intersecting angle (α 2) of the axial center line (L2), which connects the axial center of the pressure roll (36) at the downstream side in the feeding direction

and that of th second corrugating roll (14), and the reference line (L).

7. A single-faced corrugated cardboard sheet making machine as set forth in claim 6, wherein the diameter of the pressure roll (34) of which the intersecting angle (α 1) of said reference line (L) and the axial center line (L1) is set to a minimum value is set to be identical to or larger than the diameter of the other pressure roll (36).

8. A single-faced corrugated cardboard sheet making machine substantially as hereinbefore described with reference to the accompanying drawings.

The Patent Office

Applicati n N :	GB 9624427.2	**Examiner:**	Graham Werrett
Claims searched:	1-5	**Date of search:**	18 December 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): D1S

Int Cl (Ed.6): B31F

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2287483 A	(ISOWA) see Fig. 12 & page 28, line 4 on.	1, 2, 3.
X	EP 0092079 A1	(AGNATI) see page 11, line 25, to page 12, line 5)	1, 2, 3.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

Application N :	GB 9624427.2	**Examiner:**	Graham Werrett
Claims searched:	6 and 7	**Date of search:**	10 March 1997

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Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): D1S

Int Cl (Ed.6): B31F

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2287483 A	(ISOWA) see relative position of rolls 12, 14, 84, 86 in Fig. 12, & page 27, line 24 on.	6, 7.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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